

NOTE ON THE GUYRA LAGOON, N.S.W.

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(Plate xxi.)

While passing through Guyra on his road to Inverell, the writer was struck by the appearance of what is known locally as the "Mother of Ducks Lagoon." From the history, as obtained from local information, and from its physiographical aspect, the lagoon promised to be of some scientific interest; and the following note embodies the observations made in June last by the writer and his brother, Mr. M. Cotton.

Geographical.—The Guyra, or Mother of Ducks Lagoon, lies beside, and to the west of, the Sydney to Brisbane railway line, about 27 miles north of Armidale. It is oval in shape, the longer diameter being about north and south. The greatest length is 2 miles, and the greatest breadth about $1\frac{1}{4}$ miles. The town of Guyra lies on the north-eastern shore of the lake, and has an elevation of 4,330 feet above sea-level. With the exception of Black Mountain, which has the same height, and Ben Lomond, which is 143 feet higher, Guyra is the highest town on the New England railway line. At Black Mountain, however, the surrounding country is considerably higher than the railway station; while at Guyra there is a difference in level of only a few feet between the railway station and the highest point of the adjacent country.

The lagoon, when examined, was found to be hemmed in on all sides by a basalt ridge of varying height. This ridge, on the eastern side, rises about 50 feet above the bed of the lake; while, on the northern and western sides, the height is about 60 and 70 feet respectively. On the south side of the lake the ridge is

much lower, rising only to about 20 or 30 feet. At the extreme south-east corner the ground rises only a few feet above what was once the normal water-level of the lake. This breach in the basalt-ring surrounding the lake appears to be the only inlet. Through this inlet flows the water from the direction of Black Mountain, so that the catchment area of the lake is of very small



Fig.1.—Map of the Guyra Lagoon, showing (i.) the drainage-system; and (ii.) the inner crater at A.

extent. The total length of the catchment area is probably only 3 or 4 miles, and its breadth rather less than 2 miles. The hills surrounding the lake are well timbered, and slope at about 15° to 20° towards the lake-bed. The old water-level in the lake is well marked, indicating the stability of the lake for a considerable time. Nowhere could the water have exceeded a depth of 10 feet. Within the lake, at its south-western extremity, is a crescentic ridge of basalt parallel to the shore-line. This ridge gives rise to several small islands when the lake is full (see text-fig.1).

Geological.—The district for some miles round Guyra consists of a basalt-formation. This was observed to extend for some 8 miles to the south, and 5 miles to the west. The basalt noticed at Black Mountain contains phenocrysts of olivine, while in that of Guyra no such crystals were observed. This may indicate a different origin for the two lavas mentioned. A few miles to the south of Black Mountain, on the Armidale Road, the basalts were observed to overlie unconformably a series of Palæozoic sediments consisting of quartzite, slate, and conglomerate. From aneroid measurements it appears that the basalt here attains a thickness of at least 1000 feet. These sediments were seen to be intruded by granite, a few miles to the south of their junction with the basalt.

On the western side of the lagoon, a series of altered sediments was found, at a distance of 6 miles from Guyra; while, at a distance of $7\frac{1}{2}$ miles in the same direction, a very striking porphyry was met with. This rock contains phenocrysts of orthoclase and quartz, the former being so abundant as to give a pink color to the rock. It was also observed some 20 miles north of this spot.

Fig. 2 of Plate xxi., shows a diagrammatic section from north-west to south-east, through the Guyra Lagoon.

At the time when the writer visited the lagoon, the bed was being used as pasture land. Local residents state that no considerable amount of water has been present since 1902, but that previous to that year the lagoon was never known to be dry. Since 1902, small bodies of water have accumulated after heavy rains, but have quickly disappeared. So little does this basin now function as a lake, that a well sunk to a depth of 35 feet in the lake-bed failed to reach water. Locally it is commonly believed that the lake has been exhausted by the drain made upon the artesian waters in the western areas. The geological structure of the district scarcely admits of such an explanation. An obvious possible cause is a diminution in the rainfall; and with a view of ascertaining whether this afforded any explanation, the record of the rainfall of Guyra for the past

20 years was obtained from the Meteorological Bureau. The figures are given below :—

| Year. | Rainfall in inches. | Year. | Rainfall in inches. |
|-------|------------------------|-------|------------------------|
| 1886 | .. 37·72 | 1897 | ... 29·40 |
| 1887 | ... 42·53 | 1898 | ... 23·01 |
| 1888 | ... 22·85 | 1899 | ... 28·27 |
| 1889 | ... 41·55 | 1900 | ... 34·79 |
| 1890 | ... 55·44 | 1901 | ... 32·95 |
| 1891 | ... 45·52 | 1902 | ... 26·91 |
| 1892 | ... 14·11* | 1903 | ... 40·71 |
| 1893 | ... — | 1904 | ... 32·29 |
| 1894 | .. — | 1905 | ... 36·08 |
| 1895 | ... 7·74* | 1906 | ... 30·73 |
| 1896 | ... 34·52 | 1907 | ... 38·25 |

According to these figures, it will be seen that the rainfall has been quite normal since 1902.

It is also possible that earth-movements have opened fissures through which the water may have drained to lower levels. Mr. Frank Cotton has stated that the country in the immediate neighbourhood has only recently been used for cultivation, having previously been utilised for pastoral purposes. He suggests that the difference in the run-off from the hard pastoral ground, and the soft absorbent cultivated land may account for the failure of water to reach the lake. The question is one of some moment to the Lands Department, by which the lake-bed was proclaimed a temporary common in 1904. Applications are now being made to use it for agricultural purposes.

Summary.—From the evidence so far gathered, it appears that the Mother of Ducks Lagoon is an old crater-lake. The chief evidences in favor of this hypothesis are—

(1) The lake occurs in a rock of volcanic origin.

(2) The limited drainage-area, which is restricted by a continuous hill some 40-50 feet high round the lake. [The inlet at the southern end of the lake may be regarded as a breach in the old crater-ring.]

* Incomplete returns.

(3) The considerable depth of alluvial in the lake, probably representing a filling-up of the crater.

(4) The inner ridge at the south-west of the lake, which probably is a remnant of an inner crater so common in volcanoes.

(5) The great height of the lagoon, from which the land falls away in all directions (See Pl. xxi., fig.2), save immediately to the south. This rise to the south is due to the more active source of eruption at Black Mountain.

Conclusion.—In view of the evidence above given, it seems probable that many other mountain-lakes in this district, situated at high levels, such as the Ben Lomond Lagoon, are of similar origin. The identification of these lakes as centres of volcanic eruption, will be useful in solving such problems as the sequence of the lava-flows, the periods of maximum and minimum volcanic activity, and the location of deep leads.

EXPLANATION OF PLATE XXI.

Fig.1.—Guyra Lagoon, looking towards the east. The rising ground near the central part of the photo is the inner crater shown as A in text-fig.1.

Fig.2.—Section through the Guyra Lagoon from north-west to south-east, showing the geological structure of the district.

